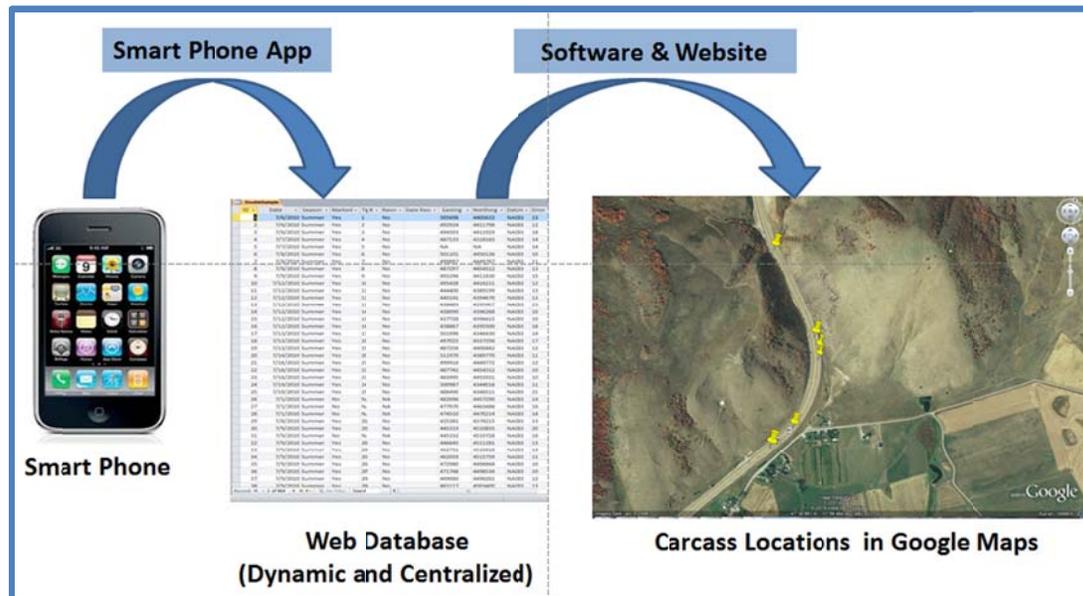


2010 ANNUAL REPORT
USGS Biological Resources Division
Utah Cooperative Fish and Wildlife Research Unit
College of Natural Resources
Utah State University, Logan UT 84322-5290



Dan Olson

Presented at the:
2011 Coordinating Meeting
College of Natural Resources
Logan, UT
13 April 2010



COOPERATORS:
USGS Cooperative Research Units Program
Utah Division of Wildlife Resources
CNR Utah State University
Wildlife Management Institute
U.S. Fish & Wildlife Service

2011 AGENDA
Annual Coordinating Committee Meeting
Utah Cooperative Fish and Wildlife Research Unit
College of Natural Resources
Dean's Conference Room
Utah State University, Logan, UT

Rotating Chair: 1992:USU,1993:NBS, 1994:UDWR,1995:WMI,1996:USU,1997:USGS, 1998:UDWR, 1999:WMI,2000:USU, 2001:USGS, 2002:UDWR, 2003:WMI, 2004:USU,2005:USGS, 2006:UDWR, 2007:WMI,2008:USU,2009:USGS,2010:UDWR:2011 WMI

Tuesday Evening Social: P. Budy @ 6:30 P.M., 456 South 100 West, Providence, UT (Map to Follow)

Wednesday 13 April 2011

8:30 **Continental Breakfast, Informal Introductions**

9:30-10:00 **State of the Unit**

10:00-12:00

- **Initiatives Presentations**

- Douglas-Jackson Smith—Water Sustainability Initiative 10:00-10:15
- Espresso Courses – Tom Edwards and Jim Powell 10:15-10:30

- **New Faculty Presentations**

- Joe Wheaton “Monitoring and Predicting Ecogeomorphic Change”
10:30-10:40
- Karen Kettenring “Spread and Control of *Phragmites* in Utah Wetlands”
10:40-10:50
- Patrick Belmont “Landscape Geomorphology and Sediment Dynamics”
10:50-11:00

- **Student Presentations**

- Daniel Olson (JB) “A Smartphone Application for Tracking Wildlife-Vehicle Collisions”
11:00-11:10
- Carl Saunders (BP) “Testing for Evidence of Biotic Resistance by Native Trout”
11:10-11:20
- Adam Brewerton (TE) “Avian Response to Fire Rehabilitation Treatments”
11:20-11:30

12:00-13:30 **Catered Lunch**

13:30-14:30 **Agency Presentations**

- USGS-Joe Margraf
- WMI – Chris Smith
- UDWR – Directors and Section Chiefs
- USU: Nat—Introduce the new Ecology Center Director

14:30

- Closed Meeting of the Primary Cooperators (UDWR, WMI, USGS, USU)

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Scott Ripple with road-killed moose, Photo by Dan Olson



Jared Bottcher and technician pull a fish seine for larval desert fishes in San Rafael River, UT. Photo by Gary Thiede



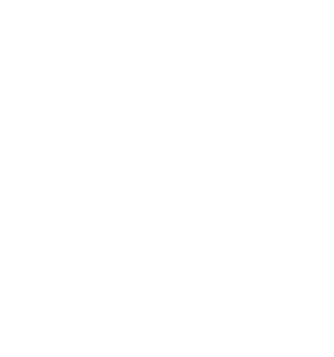
Tracy Bowerman pulls water from a piezometer to assess hyporheic water quality from within a bull trout redd. Photo by Willie Kern

2010
RESEARCH
ACTIVITIES
OF
THE UNIT STAFF

John A. Bissonette
Thomas C. Edwards, Jr.
Phaedra E. Budy

Unit Research Staff and Students

Research Associates:

	
<p style="text-align: center;">Patricia Cramer, Ph.D.</p>	<p style="text-align: center;">Mary Conner, Ph.D.</p>
	
<p style="text-align: center;">Peter MacKinnon, M.S.</p>	<p style="text-align: center;">Gary Thiede, M.S.</p>

Graduate Students & Post Docs by Degree Program:

	
<p style="text-align: center;">Justin Bingham, Wildlife Biology - Master's</p>	<p style="text-align: center;">Tracy Bowerman Fisheries Biology - Master's</p>



Adam Brewerton
Avian Ecology – Master's



Andy Dean
Fish Ecology - Master's



Jacob Gibson
Landscape Ecology - Master's

Stephen Klobucar
Aquatic Ecology - Master's



Christy Meredith,
Aquatic Ecology – Ph.D.

Daniel Olson,
Wildlife Biology - Ph.D.

	
<p>Julie Ripplinger Historical Ecology - Master's</p>	<p>Nira Salant Aquatic Ecology - Post Doc</p>
	
<p>Carl Saunders Aquatic Ecology – Master's</p>	<p>Timothy Walsworth Aquatic Ecology – Master's</p>
	
<p>Hillary White Riparian Ecology - Master's</p>	<p>Tammy Wilson Landscape Ecology - Ph.D.</p>

Mission Statement
Utah Cooperative Fish and Wildlife Research Unit
2010

The major limiting influences upon fishery and wildlife resources in the Intermountain West are terrestrial habitat degradation and loss and watershed and water issues. Loss of winter range for big game, degradation and impacts on riparian areas by agricultural practices, impacts on wildlife rangeland habitat by practices such as sagebrush removal and the planting of cattle forage, change of reservoir and riverine habitat through activities associated with hydroelectric and water delivery systems as well as the increasing influences of climate change are the major factors that have and will continue to affect natural resource management in Utah in years to come. Rapid population growth in the state has exacerbated the pressures on both the terrestrial and aquatic resource. Given these trends and the expertise of Unit personnel, the primary mission of the Unit is to address food web and habitat related problems relating to the fishery and wildlife resources of Utah and the Intermountain West.

Cooperating Faculty in the Department, College, and University are, and will continue to be, integrated into Unit research to apply diverse expertise to all facets of a research problem. In addition to the more traditional fields of biological endeavor, expertise in geographical information systems, expert systems, artificial intelligence, sociological science, survey methodology, chemical and contaminant analysis, and computer modeling and methodology, as well as other pertinent fields, can be brought to bear on resource problems. The primary motivation of the Unit is to solve pressing resource problems.

Technical expertise of the Unit staff includes: larger scale dynamics, geographical information system and habitat restoration methodology, terrestrial habitat analysis, population management and assessment, aquatic habitat ecology, fish population dynamics, aquatic food web dynamics, and quantitative study design. Our research activities focus on landscape-level habitat studies, ecological modeling of lake, reservoir, and riverine systems, avian and terrestrial ecology, and the effects of climate change. Future research directions of the Unit will continue to involve endangered fish and wildlife species, sustainable game and sport fish management, terrestrial and aquatic riparian studies, migratory non-game bird research, geographical information system methodology, and landscape-level studies involving modeling for future climate scenarios.

Graduate level courses being taught by unit personnel at Utah State University include Design and Analysis of Ecological Research (emphasizes the research process), Topics in Spatial Ecology (emphasizes space from an ecological as well as statistical perspective), Assessment of Fish and Wildlife Populations (emphasizes sampling design and estimation of abundance and survival), and Landscape Ecology (emphasizes the conceptual background of large scale ecology). Unit personnel are involved in continuing education/professional advancement short courses for agency personnel. The Unit is committed to academic pursuit of cooperator interests, and in particular, the needs of the Utah Division of Wildlife Resources. Yet, the strength of the Unit is directly related to its ability to attract outside funds. Research done in the state and region with non-cooperator funds provides added benefits to cooperators. This Unit has and will continue to address resource issues associated with its expertise to the benefit of Utah and the resource management community. Our primary objective is quality science.

UNIT PRODUCTIVITY CY 2010

Publications

Chapters in Books

- Bissonette, J.A. In Press. The issue of scale in management. Chapter 6, Pages xx *In: P.R. Krausman and J.R. Caine, (eds.), Wildlife Management: Contemporary principles and practices. The Johns Hopkins Press, Baltimore, MD, USA.*
- Edwards, T.C., Jr., D.R. Cutler, and K.H. Beard. In Press. Chapter 7. Predicting risk of invasive species occurrence-- plot-based approaches. Pages xx *In: B. Welch, (ed.), Tools for prioritizing, predicting and managing invasive plants on public lands.*
- Edwards, T.C., Jr., D.R. Cutler, and K.H. Beard. In Press. Chapter 9. The process of model assessment and evaluation. Pages xx *In: B. Welch, (ed.), Tools for prioritizing, predicting and managing invasive plants on public lands.*
- Edwards, T.C., Jr., D.R. Cutler, and K.H. Beard. In Press. Chapter 12. Predicting invasive-plant species occurrences in Klamath Network National Parks-A Process for Prioritizing Prevention. Pages xx *In: B. Welch, (ed.), Tools for prioritizing, predicting and managing invasive plants on public lands.*
- Grilo, C., J.A. Bissonette, and P.A. Cramer. 2010. Mitigation measures to reduce impacts on biodiversity. Pages 73-144 *In: S. R. Jones, (ed.), Highways: Construction, Management, and Maintenance, Nova Science Publishers, Inc., Hauppauge, NY 11788. ISBN: 978-1-61728-862-3 https://www.novapublishers.com/catalog/product_info.php?products_id=15946*
- McIntosh, A., P.A. McHugh, and P. Budy. In Press. Invited book chapter. Brown Trout, Chapter xx *In: Handbook of Global Freshwater Invasive Species. (<http://www.earthscan.co.uk/>).* Hardcopy available 2011.

Peer- Reviewed Papers

- Albert, C.H., N.G. Yoccoz, T.C. Edwards, Jr., C. H. Graham, N.E. Zimmermann, and W. Thuiller. 2010. Sampling in ecology and evolution – bridging the gap between theory and practice. *Ecography* 33:1028-1037.
- Al-Chokhachy, B. Roper, T. Bowerman, and P. Budy. 2010. A review of bull trout habitat associations and exploratory analyses of patterns across the Interior Columbia River Basin. *North American Journal of Fisheries Management* 30:464-480.
- Bolliger, J., T.C. Edwards, Jr., S. Eggenberg, S. Ismail, I. Seidl, and F. Kienast. In Press. Dry grassland meadows of high conservation priority: balancing forest regeneration probabilities and maintenance costs. *Conservation Biology*.
- Budy, P., M.E. Baker, and S.K. Dahle. In Press. Predicting fish growth potential and identifying potential water quality issues: A spatially explicit bioenergetics approach. *Environmental Management*.
- Grilo, C., F. Ascensão, M. Santos-Reis, and J. A. Bissonette. 2011. Do well connected landscapes promote road-related mortality. *European Journal of Wildlife Research*. (Online first DOI: 10.1007/s10344-010-0478-6)
- Hansen, E.S., and P. Budy. In Press. The potential of passive stream restoration to improve ecosystem health and minimize the impact of disease on fish: A short-term assessment. *Journal of the North American Benthological Society*.
- Larsen, R.T., J.A. Bissonette, J.T. Flinders, M.B. Hooten, and T.L. Wilson. 2010. Summer spatial patterning of chukars in relation to free water in Western Utah. *Landscape Ecology* 25:135-145.

- Larsen, R.T., J.A. Bissonette, J.T. Flinders, and A.C. Robinson. In Press. Does small-perimeter fencing inhibit antelope and mule deer use of free water? *Journal of Wildlife Management*.
- Meier, E.S., T.C. Edwards Jr, F. Kienast, M. Dobbertin, and N.E. Zimmermann. In Press. Co-occurrence patterns of trees along macro-climatic gradients and their potential influence on the present and future distribution of *Fagus sylvatica* L. *Journal of Biogeography*.
- Miller, S.W., P. Budy, and J.C. Schmidt. 2010. Quantifying macroinvertebrate responses to in-stream habitat restoration: Applications of meta-analysis to river restoration. *Restoration Ecology* 18:8-19.
- Seidel, S., P. Budy, D. Koons, and B. Roper. In Press. Exploring spawning dynamics and potential limiting factors for the early life stages of native cutthroat trout. *North American Journal of Fisheries Management*.
- Vinson, R., and P. Budy. 2010. Sources of variability and comparability between salmonids stomach contents and isotopic analyses: Study design lessons and recommendations. *Canadian Journal of Fisheries and Aquatic Sciences* 68:137-151.
- Wilson, T. L., F. P. Howe, and T. C. Edwards, Jr. In Press. Effects of sagebrush treatments on multi-scale resource selection by pygmy rabbits. *Journal of Wildlife Management*.
- Wilson, T. L., J.B. Odei, M.B. Hooten, and T.C. Edwards, Jr. 2010. Hierarchical spatial models for predicting pygmy rabbit distribution and abundance. *Journal of Applied Ecology* 47:401-409.
- Zimmermann, N.E., T.C. Edwards, Jr., C.H. Graham, P.B. Pearman and J-C Svenning. 2010. New trends in species distribution modelling. *Ecography* 33:985-989.

Special Issue Publication

- Zimmermann, N.E., T.C. Edwards, Jr., C.H. Graham, P.B. Pearman and J-C Svenning, Guest Editors. 2010. New trends in species distribution modelling. *Ecography* 33:985-1092. Special Issue: Species Distribution Modelling (10 Papers)

Submitted

- Beard, K.H., C.A. Faulhaber, S.L. Durham, F.P. Howe, and T.C. Edwards Jr. Indirect interactions among rodents and seeds in a shrubsteppe ecosystem. *Journal of Applied Ecology*.
- Bissonette, J.A., and S. Rosa. A mitigation strategy for deer-vehicle collisions in southern Utah: Evaluation of effectiveness. *Journal of Wildlife Management*.
- Edwards, T.C. Jr., F. Kienast, J. Bolliger, and T. Dalang. Maintaining high Alp dry grassland meadows of high conservation priority under short- and long-term ecological change. *Biological Conservation*.
- LobónCerviá, J., G. González, and P. Budy. Mechanisms underlying spatial and temporal variations in the production rates and turnover (production/biomass) ratios in Cantabrian stream-resident Brown Trout *Salmo trutta* L. populations. *Freshwater Biology*.
- Nadolski, B.K., and P. Budy. A multi-scale evaluation of the factors that influence non-native brook trout and endemic cutthroat trout distribution and abundance. *Transactions of the American Fisheries Society*.
- Norvell, R.E., T.C. Edwards, Jr., and F.P. Howe. Disturbance as restoration in shrubsteppe: mixed effects on non-target bird species. *Condor*.
- Salant, N.L., J.C. Schmidt, P. Budy, P.R. Wilcock. Unintended consequences of restoration: Loss of riffles and gravel substrates following weir installation. *Journal of Environmental Management*.

- Weber, P.A., P. Thompson, and P. Budy. Status and structure of two populations of bluehead in the Weber River, UT. *Southwest Naturalist*.
- Wilson, T.L., A.P. Rayburn, and T.C. Edwards, Jr. Spatial ecology of refuge exploitation by a vulnerable herbivore. *Oikos*.

Technical Reports

- Bissonette, J.A., G.C. White, and P.R. Krausman. 2010. Review of Mule Deer Monitoring Plan, Pinedale (WY) Anticline. Submitted to the Mule Deer Monitoring Plan Review Committee, Wyoming Game and Fish Department and the Wyoming BLM. 11 Pages.
- Budy, P., T. Walsworth, and G.P. Thiede. 2010. Habitat needs, movement patterns, and vital rates of endemic Utah fishes in a tributary to the Green River, Utah. 2009 Annual Report to the Bureau of Reclamation, Upper Colorado Region. *UTC FWRU 2010(1)*:1-45.
- Budy, P., G.P. Thiede, C. Meredith, and R. Chaston. 2010. Logan River whirling disease study: factors affecting trout population dynamics, abundance, and distribution in the Logan River, Utah. 2008 Annual Report to Utah Division of Wildlife Resources. Sport Fish Restoration, Grant number XIII. Project F-47-R. *UTC FWRU 2010(2)*:1-55.
- Budy, P., T. Bowerman, and G.P. Thiede. 2010. Bull trout population assessment in northeastern Oregon: a template for recovery planning. 2009 Annual Progress Report to US Fish and Wildlife Service. *UTC FWRU 2010(3)*:1-48.
- Budy, P., A. Dean, G.P. Thiede, D. Olsen, and G. Rowley. 2010. Triploid trout in high Uinta lakes: A comparative evaluation of relative performance of triploid versus diploid brook trout. 2009 Annual Report to Utah Division of Wildlife Resources. Sport Fish Restoration, Grant number XIII. Project F-47-R. *UTC FWRU 2010(4)*:1-65.
- Budy, P., B. Nadolski, and G.P. Thiede. 2010. Mill Creek trout study: Factors affecting trout population dynamics, abundance, and distribution in the Mill Creek Basin, Utah. Project Completion Report to Utah Division of Wildlife Resources. Sport Fish Restoration. Grant Number XIII. Project F-47-R. *UTC FWRU 2010(5)*:1-34.
- Miller, S.W., N.L. Salant, P. Budy, J.C. Schmidt. 2010. Assessing responses of Bonneville cutthroat trout to restoration strategies implemented under the 1997 Conservation Agreement. 2009 Annual Report. Endangered Species Mitigation Fund Project Number: 0809. *ICRRR 2009(1)*.
- Salant, N.L., J.C. Schmidt, P.R. Wilcock, and P. Budy. 2010. Geomorphic history and current channel condition of the Donner und Blitzen River, Malheur National Wildlife Refuge, Oregon. Report submitted to the U.S. Fish and Wildlife Service (Cooperative Agreement No. 10190-9-J001), Portland, Oregon. April, 2010. *ICRRR 2010(2)*:1-82.

Students Directed

Theses and Dissertation Completed

J.A. Bissonette

- Bingham, J. 2010. Causes and consequences of lead-pellet ingestion by chukars (*Alectoris chukar*) in Western Utah: Examining soil, search images, and toxicology, M.S. Thesis, Utah State University, Logan UT.

T.C. Edwards

- Gibson, J. 2010. Individualistic responses of piñon and juniper distributions to climate change. M.S. Thesis, Utah State University, Logan UT.
- Ripplinger, J. 2010. Legacy effects in sagebrush steppe: The key to understanding the future. M.S. Thesis, Utah State University, Logan UT.

Wilson, T.L. 2010. Effects of anthropogenic disturbance on habitat use of pygmy rabbits: the role of legacy effects. Ph.D. Dissertation, Utah State University, Logan UT.

Active Graduate Research Projects

J.A. Bissonette

Dan Olson, Ph.D. Candidate. Modeling population effects of deer vehicle collisions. Expected completion 2013.

Hillary White, M.S. Candidate. Developing riparian bird habitat association models and management guidelines. Expected Completion March 2011.

Teresa Sales Luis. Ph.D. Candidate. Niche breadth and patterns of distribution and abundance of Eurasian otters in southern Portugal: Conservation implications, (Co-chair with Dr. Margarida Santos Reis, University of Lisbon) Expected completion 2011.

T. C. Edwards

Adam Brewerton. M.S. Candidate. Fire effects on ground-nesting passerine birds. Expected Completion December 2011

P. Budy

Bowerman, Tracy. Ph.D. Candidate. Understanding the effects of land use and natural variation in habitat on early life-history of threatened bull trout. Expected completion 2011.

Dean, Andy. M.S. Candidate. Comparative survival of triploid brook trout and food web interactions in high Uinta lakes. Expected completion May 2011.

Meredith, Christy. Ph.D. Candidate. Geomorphic controls of exotic fish expansion. Expected Completion August 2011.

Walsworth, Timothy. M.S. Candidate. Understanding the role of source sink dynamics in controlling population persistence of imperiled desert fishes. Expected completion August 2011.

Klobucar, Stephen. M.S. Candidate. Can morphology, productivity, and biotic community diversity predict fish production potential across a diversity of lentic systems? Expected Completion May 2013.

Active Undergraduate Research Projects

P. Budy

Gilbert Rowley. 2010. Prey selection and diet selectivity of introduced brook trout in high Uinta mountain lakes: implications for food web dynamics. Completion report: Gilbert will be a co-author on a manuscript to be submitted as North American Journal of Fisheries Management.

Reed Chaston. 2010. Abundance, condition, and habitat use of brown trout in the Right Hand Fork tributary, Utah: lessons for brown trout management. Presented as a poster at Utah (formerly Bonneville) Chapter of the American Fisheries Society, 2010 Annual Meeting.

Active Post-doctoral Fellows Mentored

P. Budy

Salant, Nira. 2009- present. Advancing the science and practice of river restoration. Intermountain Center for River Rehabilitation and Restoration. Co-Advised with Jack Schmidt.

W. Carl Saunders. 2010- present. A test of the theory of biotic resistance: novel options for native fish restoration.

Presentations

Invited

- Bissonette, J.A. 2010. Visualizing landscape patterns: No black and white anymore. University of Lisbon, 27 October 2010, Lisbon Portugal. n=40
- Bissonette, J.A. 2010. Deer mortality in Utah: Mitigation for a permeable landscape. Albert Ludwigs University of Freiburg, Germany 24 November 2010, Freiburg, Germany. n=35
- Budy, P., G.P. Thiede, K. Landom, and T.A. Crowl. 2010. Quantifying consumption by a nonnative piscivore assemblage: implications for recovery of the endangered June sucker. 'Sucker Summit' Special Symposium, American Fisheries Society, Western Division, Salt Lake City, 20-23 April, 2010.
- Budy, P. 2010. How do you identify the limiting factor for fish (biota)? Stream Restoration Design Analysis and Decision Guidance, Symposium. Utah State University, 24-24 August, 2010.
- Saunders, W.C., P. Budy, and G. Thiede. 2010. Bonneville cutthroat trout restoration in the Logan River. Bonneville Cutthroat Trout Recovery Team, Salt Lake City, 3 November, 2010.
- Walsworth, T., P. Budy, and G.P. Thiede. 2010. A patch approach to understanding the effect of stream degradation on food web and population structure of imperiled fishes. American Fisheries Society 140th Annual Meeting, Pittsburgh, PA, 15 September, 2010.
- Edwards, T.C., Jr. 2010. Evaluating species distribution models: what, why and how? Invited paper, University of Lausanne, Lausanne, Switzerland, 20 May, 2010.
- Edwards, T.C., Jr. 2010. Modelling high elevation Alp dry grassland meadows futures under scenarios of short- and long-term ecological change: how to prioritize management and conservation actions. Swiss Federal Research Lab WSL, Birmensdorf, Switzerland, 27 May, 2010.
- Edwards, T.C., Jr. 2010. Ensemble modelling approaches in forecast environments: reasons the "best" Switzerland, 22 September 2010.
- Landom, K., T.A. Crowl, and P. Budy. 2010. Introduced sport fish and fish conservation in a novel food web: evidence of predatory impact. 'Sucker Summit' Special Symposium, American Fisheries Society, Western Division, Salt Lake City, 20-23 April, 2010.
- Meredith, C.S., P. Budy, and J. Schmidt. 2010. The influence of geomorphic-hydrologic factors on invasion potential of brown trout (*Salmo trutta*) in a mountain stream. 'Brown Trout in the West' Special Symposium, Budy, Co-Chair, American Fisheries Society, Western Division, Salt Lake City, 20 April, 2010.
- Thompson, P., P.A. Weber, P. Budy, and S. McKay. 2010. A comparative investigation of population size, structure, movement patterns and vital rates between two populations of bluehead sucker (*Catostomus discobolus*) in the Weber River, Utah: Identifying limiting factors to guide conservation. 'Trash fish or native treasures, Three Species' Special Symposium, American Fisheries Society, Western Division, Salt Lake City, 20-23 April, 2010.
- Walsworth, T.P. Budy, and G.P. Thiede. 2010. Patch Approach to Understanding the Effect of Stream Degradation on Food Web and Population Structure of Imperiled Fishes. 'Trash fish or native treasures. Three Species' Special Symposium, American Fisheries Society, Western Division, Salt Lake City, 20-23 April, 2010.

Wilson, T.L., and T.C. Edwards, Jr. 2010. Multiscale investigations of pygmy rabbit spatial ecology. Patuxent National Wildlife Research Center, Laurel, Maryland, 22 April 2010.

Contributed

Bowerman, T. and P. Budy. 2010. How do habitat connectivity and dispersal rates affect population dynamics of an imperiled freshwater fish? Poster Presentation, Society for Conservation Biology, International Annual Meeting, Edmonton, Alberta, Canada, July 5-9, 2010.

Bowerman, T., P. Budy, R. Al-Chokhachy, and H. Schaller. 2010. Patterns of bull trout movement and life history expression: what can we learn from multiple years and multiple sites using passive PIT-tag antennae? 'Small river advances in PIT-tags...' Special Symposium, Budy, Co-Chair, American Fisheries Society, Western Division, Salt Lake City, 20-23 April, 2010.

Budy, P., G.P. Thiede, J. Lobon-Cervia, G. Gonzalez, P.A. McHugh, A. Mcintosh, A. Vollestad, and E. Becares. 2010. A mechanistic evaluation of brown trout performance across their native and exotic habitat: lessons for managing invasive trout. 'Brown Trout in the West' Special Symposium, Budy, Co-Chair, American Fisheries Society, Western Division, Salt Lake City, 20 April, 2010.

Budy, P., G.P. Thiede, J. Lobon-Cervia, G. Gonzalez, P.A. McHugh, A. Mcintosh, A. Vollestad, and E. Becares. 2010. A cross-continental, comparison of factors limiting the endemic and exotic distribution of brown trout: How can estimating bioenergetic efficiency inform management and conservation? Budy Program Chair and Convenor, International Symposium, Advances in the Population Ecology of Stream Salmonids, Lueca (Asturias, Spain), 17-21 May, 2010.

Budy, P., G.P. Thiede, W.C. Saunders. 2010. An evaluation of trout community population change following two years of mechanical removal of non-native brown trout: towards a better understanding of restoration options for imperiled native fishes. 42nd Annual Meeting of the Desert Fishes Council, Moab, UT, 18-21 November, 2010.

Budy, P., G.P. Thiede, J. Bottcher, and T. Walsworth. 2010. The importance of small tributary streams to endangered fishes of the Colorado River Basin: an example from the San Rafael River, Utah. Poster Presentation. 42nd Annual Meeting of the Desert Fishes Council, Moab, UT, 18-21 November, 2010.

Chaston, R., P. Budy, and G.P. Thiede. 2010. Distribution and habitat choice of brown trout (*Salmo trutta*) in Right Hand Fork, a tributary to the Logan River, Utah: Monopolizing on a large-scale removal effort to better understand habitat limitations on brown trout invasion success. Poster. American Fisheries Society, Western Division, Salt Lake City, 20-23 April, 2010.

Dean, A., P. Budy, and G.P. Thiede. 2010. A comparison of triploid vs. diploid brook trout relative performance in high Uinta lakes: who is the biggest loser? American Fisheries Society, Western Division, Salt Lake City, 20-23 April, 2010.

Edwards, T.C., Jr., F. Kienast, and J. Bolliger. Assessing the effectiveness of agro-environmental conservation programs in maintaining high alp meadow. 2010 Meeting of the U.S. Chapter of the International Association for Landscape Ecology, Athens, Georgia, 6 April 2010.

- Gibson, J.R., G.G. Moisen, T.S. Frescino, and T.C. Edwards, Jr. Assessing the effect of using fuzz/swapped vs. real coordinates on species distribution models in Piñon-Juniper forests. 2010 Annual Forest Inventory and Analysis Symposium, Knoxville, Tennessee, 6 October 2010.
- Klobucar, S.L., P. Budy, and G.P. Thiede. 2010. Unknown waters of the Uintah Basin: evaluating the limnology, morphometry, and fish communities of seven lentic waters on the Uintah and Ouray reservation, Utah. Poster Presentation. 42nd Annual Meeting of the Desert Fishes Council, Moab, UT, 18-21 November, 2010.
- Salant, N.L., M.B. Baillie, S.W. Miller, P. Budy, and J.C. Schmidt. 2010. Imperfect realities: Practical strategies for monitoring geomorphic and ecological responses to trout habitat restoration. American Fisheries Society, Western Division, Salt Lake City, 20-23 April, 2010.
- Thiede, G.P., P. Budy, J. Wood, and N. Burbank. 2010. Is predation by invasive brown trout a threat to native fish persistence? Poster Presentation. 42nd Annual Meeting of the Desert Fishes Council, Moab, UT, 18-21 November, 2010.
- Walsworth T., P. Budy, and G.P. Thiede. 2010. A Patch Approach to Understanding the Effect of Stream Degradation on Food Web and Population Structure of Imperiled Fishes. Presentation, American Fisheries Society 140th Annual Meeting, Pittsburgh, PA, September 15, 2010.
- Walsworth, T., P. Budy, and G.P. Thiede. 2010. Longer food chains and crowded niche space: understanding trophic interactions between non-native and endemic, riverine desert fishes. 42nd Annual Meeting of the Desert Fishes Council, Moab, UT, 18-21 November, 2010.
- White, H., F. Howe, and J.A. Bissonette. 2010. Riparian bird-habitat association models: A framework for developing management and restoration guidelines in Utah, The Wildlife Society, Snowbird, UT. 2-6 October 2010.
- Wilson, T. L, and T. C. Edwards, Jr. Spatial patterns of burrow use by pygmy rabbits. 2010 Meeting of the U.S. Chapter of the International Association for Landscape Ecology, Athens, Georgia, 7 April 2010.
- Wilson, T. L, and T. C. Edwards, Jr. Effects of seismic exploration on pygmy rabbits. 16th Annual Wildland Shrub Symposium, Logan, Utah, 18 May 2010.

University Courses

J.A. Bissonette

WILD 6710-7710, Wildlife Ecology (Spring 2010, 12 students)

T. C. Edwards

WILD 6510, Topics in Spatial Ecology: Species Distribution Models Using R (Spring 2010, 28 students)

WILD 6500, Biometry (Fall 2010, 24 students)

P. Budy

WATS 3100/5100, Fish Diversity and Conservation (Fall 2010, 32 students)

WATS 3100/5100, Fish Diversity and Conservation Laboratory Practicum (Fall 2010, 10 students)

Workshops

J. A. Bissonette

Visiting Professor at Albert-Ludwigs-Universitaet Freiburg, three week short course in landscape ecology, 8-26 Nov. 2010

T. Edwards

Co-Instructor, ECOCHANGE: Predictive habitat distribution models: tools for building projections of global change impact on biodiversity. Swiss Federal Research Lab WSL, Birmensdorf, Switzerland, 19-24 September 2010. (38 Students)

Instructor, NCTC Course #CSP4220, Data Analysis IIIA: Species Distribution Modeling Using R. Panama City, FL, 4-8 January 2010. (15 FWS students)

Instructor, NCTC Course #CSP4240, Data Analysis IV: Bioclimatic Forecast Modeling Using R. Panama City, FL, 18-23 April 2010. (13 FWS students)

P. Budy

Principles of Stream Restoration – Part I, Utah State University, Intermountain Center for River Rehabilitation and Restoration & Department of Watershed Sciences. Co-taught with J. Schmidt and P. Wilcox. 5-day short course. 2003, 2004, 2005, 2006, 2007, 2008, 2010 (Park City, UT).

Outreach and Distance Education

Public Presentations

P. Budy

Invited Presentation to UDWR –Bonneville Cutthroat Trout Range-Wide Coordination Group. 2010. An evaluation of the relative performance of diploid and triploid trout with consideration of the effects of lake morphology and fish density. UDWR, Salt Lake City, UT. 3 November, 2010.

Invited Presentation to UDWR –Three Species Annual Conservation Team. 2010. Four years of study on the San Rafael: Where have we come and where are we going? UDWR, Salt Lake City, UT. 27 October, 2010.

Invited Presentation to Bonneville Cutthroat Trout Recovery Team. 2010. Saunders, W.C., P. Budy, G. Thiede. Bonneville Cutthroat Trout Restoration in the Logan River. Salt Lake City, 3 November, 2010.

Invited External Thesis and Dissertation Examiner

J. A. Bissonette

Heinrichs, Julie. 2010. The relative effects of habitat quantity, quality, and configuration on population extinction, Department of Geography, University of Calgary, Calgary Alberta Canada (Supervisor: Dr. Darren Bender).(31 August 2010)

Vetter, Daniela. 2010 (begin) Effects of tropical forest fragmentation on vertebrates, University of Freiburg, Freiburg, Germany.

Glatthaar, Libby Bickford. 2010 (begin). The effect of landscape fragmentation on the dispersal behaviour, demography, population genetics and species diversity of the small mammals of the Black Forest. Faculty of Forest and Environmental Sciences, Wildlife Ecology and Management Department, University of Freiburg.

T. Edwards

Engler, R. 2010. Unfolding nature *in silico* – Overcoming practical and methodological limitations of species distribution models: Applications to conservation biology and climate change assessment. Thèse de doctorate ès sciences de la vie (PhD), Diplôme en Biologie, Université de Lausanne, Suisse. (Supervisor: Dr. Antoine Guisan)

Professional Service

J.A. Bissonette

Reviewer for: Acta Theriologica, American Midland Naturalist, Biological Conservation, Cooperative Grants Program-US Civilian Research and Development Foundation, Conservation Biology, Environmental Management, Journal of Mammalogy, Landscape and Urban Planning, Chapter on wolf recovery for edited book, Journal of Wildlife Management, Journal of Applied Ecology, Landscape Ecology, Ambio, Annals of the Association of American Geographers, Bioscience, CSIRO Wildlife Research, European J. Wildlife Research, Ecological Applications, Environmental Management, Human Dimensions of Wildlife, International Journal of Biodiversity Science and Management, Wildlife Biology in Practice, Environmental Monitoring and Assessment, and proposals from National Science Foundation and NSERC

Editorial Board: European Journal of Wildlife Research, 2003-present

Coordinating Editor: Landscape Ecology, 2008-present

Member: TWS 75th Anniversary Celebration Committee

Member: TWS 4th International Wildlife Management Congress, 2012

T.C. Edwards

Reviewer for: Journal of Wildlife Management, Condor, Current Ornithology, Conservation Biology, Wildlife Society Bulletin, Ecology, Ecological Monographs, Remote Sensing and Environment, American Naturalist, Ecological Applications, Landscape Ecology, Ecological Modelling, Environmental Management, Biological Conservation, Journal of Vegetation Science, Trends in Ecology and Evolution, Diversity and Distributions, Ecography

Editorial Board: International Association of Vegetation Scientists (Journal of Vegetation Science)

Editorial Board: Ecography

Secretary General: International Association of Landscape Ecology

P. Budy

Reviewer for (2010): Environmental Management, North American Journal of Fisheries Management, Diversity and Distributions: A Journal of Conservation Biogeography, Journal of Limnology and Oceanography, Oecologia, Ecology of Freshwater Fish, Oikos, Biological Invasions

Member: USFWS Bull Trout Research, Monitoring, and Evaluation Tech Team, 2003-present
Associate Editor, 2010 – present, Ecology of Freshwater Fish.

Program Chair and Convener. International Symposium, Advances in the Population Ecology of Stream Salmonids, Lueca (Asturias, Spain), May, 17-21, 2010.

Co-Chairs: Budy and Burnett. 'Brown trout in the West'. Special Symposium, American Fisheries Society, Western Division, Salt Lake City, April 20-23, 2010.

Co-Chairs: Al-Chokhachy and Budy. 'Small river advances in PIT-tags and capture-recapture: from field data to analyses to application in fisheries research and monitoring'. Special

Symposium, American Fisheries Society, Western Division, Salt Lake City, April 20-23, 2010.

Research Grade Evaluation Panelist, US Geological Survey, New Orleans, March 2010.

Assistant Director, Intermountain Center for River Rehabilitation and Restoration, Utah State University. 2006 – present.

Research

J. A. Bissonette

- 2007-2009 Lead pellet ingestion by chukars in the west desert (PI)
- 2006-2008 Water ecology of chukars (*Alectoris chukar*): implications for species management in arid environments. (PI).
- Utah Division of Wildlife Resources, Utah Habitat Council, Utah Chukar Foundation, Water for Wildlife Foundation, Sportsman for Habitat, Nevada Chukar Foundation, Carson Valley Chukar Club, Pheasants Forever, Salt Lake County Fish and Game Association, Pershing County Chukars Unlimited, Utah State Parks, BYU, USU Quinney Foundation, \$489,361. BOTH COMPLETED.
- 2004-2007 Evaluation of the use and effectiveness of wildlife crossings. Phase 1&2. (PI).
- National Academy of Sciences, TRB, NCHRP, \$559,000. COMPLETED.
- 2007-2008 Evaluation of the use and effectiveness of wildlife crossings. Phase 3 (PI).
- National Academy of Sciences, TRB, NCHRP, \$75,000. COMPLETED.
- 2006-2011 Riparian bird habitat models and habitat guidelines (Co-PI).
- Utah Division of Wildlife Resources \$130,850. COMPLETED 3/24/11.
- 2009-2013 Modeling population effects of deer vehicle collisions, (PI)
- Utah Division of Wildlife Resources \$269,610, ONGOING

T. C. Edwards

- 2010-2012 Colorado plateau rapid ecoregional assessment (Co-PI)
- Bureau of Land Management, \$127,300 ONGOING
- 2009-2012 Sustainable communities and landscape designs (PI).
- U.S. Geological Survey, \$349,500. ONGOING.
- 2009-2011 Effects of projected climate change on distribution patterns of Western North America conifers (PI).
- USDA Forest Service, Rocky Mountain Research Station, \$125,000. ONGOING.
- 2009-2012 Assessing the importance of biotic interactions for predicting the impact of climate change on the future distribution of plant assemblages (Co-PI).
- Swiss National Science Foundation, \$425,000 CHF. ONGOING.
- 2007-2011 ECOCHANGE: Challenges in assessing and forecasting biodiversity and ecosystem changes in Europe (Co-PI)
- European Union (funded through Swiss Federal Research Lab WSL, Birmensdorf, Switzerland), \$7,000,000€ (\$713,170€ WSL). ONGOING.

P. Budy

- 2010 A test of the biotic resistance hypothesis with native and exotic trout assemblages in Intermountain West stream ecosystems: Towards a better understanding of native trout restoration options. USGS Western Region: State Partnership Program, \$35,000. ONGOING.

- 2010 An evaluation of a large-scale restoration effort for Bonneville cutthroat trout in Righthand Fork following non-native brown trout removal: Towards a better understanding of restoration options for imperiled native fishes. UDWR - Endangered Species Mitigation Fund, \$39,154. ONGOING.
- 2010-2012 NSF: WSC- Category 1: Hydrologic and ecological impacts of changes in human water resource management in response to climate change and urbanization. D. Jackson-Smith and 15 others, Total Award, \$149,943. ONGOING.
- 2010-2012 Evaluating fish growth and production potential across Ute Reservation reservoirs. The Ute Indian Tribe, Uintah and Ouray Reservation, Total Award \$100,951. ONGOING.
- 2010-2011 Non-Point Source Program Evaluation: Solicitation AR10167. State of Utah Co:PI with Mesner, Jackson-Smith, and Stevens, State of Utah, Total Award \$149,821 ONGOING.
- 2002-present Limiting factors affecting trout population dynamics, abundance, and distribution in the Logan River, Utah: Population dynamics, disease, and synergistic effects. UDWR, 2010 = \$53,788, Total Award \$580,317. ONGOING.
- 2009-2010 Upper Donner und Blitzen River geomorphology study. P.I.s: Phaedra Budy and Jack Schmidt, US Fish and Wildlife Service (USFWS), R1/R8 Water Resources Branch, 2009-2010, Total Award \$25,000. ONGOING.
- 2002-present Bull trout population assessment and life history characteristics in association with habitat quality and land use: Template for recovery planning 2009 = 123,300, US Fish and Wildlife Service (USFWS), Total Award \$1,114,658. ONGOING.
- 2007-2011 Habitat needs, movement patterns, and vital rates of endemic Utah fishes in a tributary to the Green River, Utah. Bureau of Reclamation Primary (BOR), UDWR Secondary. 2010 = \$60,488, Total Award \$292,474. ONGOING.
- 2008-2010 Comparative survival of triploid brook trout and food web interactions in high Uintah lakes. Utah Division of Wildlife Resources (UDWR), 2010 = \$33,695, Total Award \$161,326. ONGOING.

Recognition and Awards

Leaders:

T.C. Edwards

Recipient, National Cooperative Research Units Recognition Star Award, US Department of Interior (2) CRU, and Mendenhall Postdoctoral Research Fellows Program

P.Budy

Recipient, National Cooperative Research Units Performance Star Award, US Department of Interior CRU.

Students and Faculty Collaborators:

White, Hillary. 2010. Utah State University, Intermountain Graduate Research Symposium, Logan, UT, April 2010. 3rd Place for Best Oral Presentation, Natural Resources Category

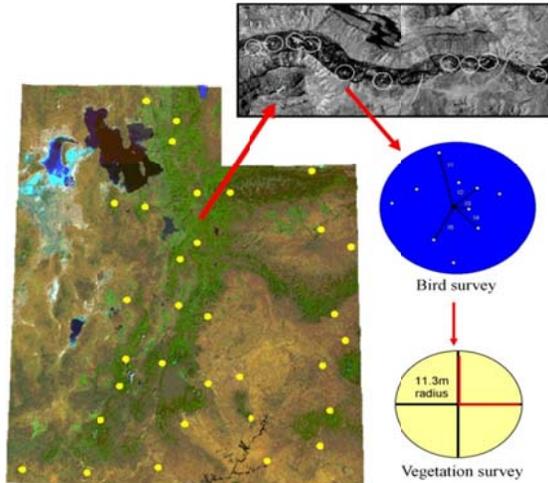
Developing Riparian Bird-Habitat Association Models in Utah: A Framework for Successful Management and Restoration Assessing

Dates:

2006-2010 (Completed March 2011)

Abstract:

Approximately 75% of the avian species in Utah use riparian habitats at some time during their life cycles and at least 80% of this habitat in Utah has been lost or altered since settlement; currently < 0.6% of land cover in Utah is considered riparian. In 1992, the Utah Division of Wildlife Resources began a statewide neotropical migratory bird (NTMB) and habitat monitoring program to assess the status of bird populations at over 50 riparian survey sites. Our primary study goals were to: 1) assess population trends for focal avian species, 2) describe changes in riparian vegetation over time, and 3) investigate how these two processes are related by creating bird-habitat association models. Recent results from population trend analyses suggest that the patterns of annual variation and regional synchrony seen in riparian-dependent species groupings may be driven by landscape-wide effects on habitat. I developed riparian-bird habitat association models to better understand these large scale effects. I constructed classification and regression trees for riparian dependent species of interest as well as for 3 distinct foraging guilds to assess species-specific and community level habitat associations. Model results are intended to provide the framework for the development of management guidelines that will inform terrestrial riparian restoration and conservation efforts in Utah.



Funding:

Utah Division of Wildlife Resources (UDWR), U.S. Fish and Wildlife Service (USFWS)
U.S. Forest Service (USFS), Utah Bureau of Land Management (BLM), U.S. Geological Survey (USGS),
Utah Reclamation and Mitigation Conservation Commission (URMCC)
U.S. Bureau of Reclamation (BOR), Utah State University (USU)

Investigators:

Hillary M. White, Utah Division of Wildlife Resources, USU Graduate Research Assistant
John A. Bissonette, U.S. Geological Survey UTCFWRU and Utah State University
Frank P. Howe, Utah Division of Wildlife Resources

Reports:

Population monitoring of neotropical migratory birds in riparian habitats of Utah. UDWR
Publication Number 07-17; 2007

Causes and consequences for Lead-Pellet Contamination of Chukars (*Alectoris Chukar*): Examining Habitat, Search Images, and Toxicology

Dates:

Fall 2007- 2010 (Completed)

Abstract:

Lead ingestion adversely affects humans and over 130 species of wildlife. Lead-pellet ingestion by Chukars (*Alectoris chukar*) has been documented recently, but the causes and consequences of this ingestion are poorly understood. The objectives of this research were to 1) evaluate the utility of different response variables that are commonly used to assess elevated lead exposure, 2) estimate background versus elevated lead exposure for our sample population, and 3) investigate the extent, severity, and causes of lead-pellet ingestion by chukars. Liver-lead concentrations and presence of ingested lead pellets were useful for assessing recent lead exposure in chukars. In conjunction with data from captive chukars dosed with lead, I was able to differentiate between bone-lead concentrations from chronic and acute exposure. All wild chukars had bone-lead concentrations consistent with background lead-exposure. Using liver tissue, I calculated 3 estimates for the threshold of background versus elevated lead exposure for my sample population—*Low* (0.035 $\mu\text{g/g}$), *Moderate* (0.2 $\mu\text{g/g}$), and *High* (0.5 $\mu\text{g/g}$). With the high estimate, I determined that 11.5% (n=54) of my sample contained either an ingested lead pellet (n=43) or elevated lead in liver tissue (n=11). I documented individuals from seven different mountain ranges with an ingested lead pellet or elevated liver lead. Frequency of ingested lead was above average for the Cedar, Deep Creek, Gilson, and the Stansbury Mountains. I recorded 19 instances of ingested lead during June-October (n=221) and 20 during November-January (n=193). I observed 14 events of elevated liver lead for June-October (n=97), but did not find a single occurrence during November-January (n=24). The frequency of lead-pellet ingestion by captive chukars increased significantly when fed a diet with a greater density of lead pellets. The diet was composed of seeds and grit items that were very similar visually to lead pellets. I estimated a density of 1,712,134 lead pellets/ha (lp/ha) in soils at an area used for target shooting; as many as 58,600 lp/ha in soils near springs; and up to 2,445 lp/ha in soils surrounding water catchments (guzzlers) and reference points, all of which were within occupied mourning dove (*Zenaida macroura*) and chukar habitat.



Funding:

Utah Department of Natural Resources (Division of Wildlife, Division of State Parks), Nevada Department of Wildlife, Water for Wildlife, Utah Chukar and Wildlife Foundation, Carson Valley Chukar Club, Pershing County Chukars Unlimited, Salt lake County Fish and Game, and Nevada Chukar Foundation

Investigators:

John A. Bissonette, U.S. Geological Survey and Utah State University (CO-PI)
Randy T. Larsen, Brigham Young University (CO-PI)
R. Justin Bingham, Graduate Research Assistant (M.S. Candidate)

Reports:

Bingham, R. J., R. T. Larsen, J. A. Bissonette, and J. T. Flinders. 2009. Causes and consequences of ingested lead pellets in Chukars. Extended abstract in R. T. Watson, M. Fuller, M. Pokras, and W. G. Hunt, (Eds.). Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA. DOI 10.4080/ilsa.2009.0204

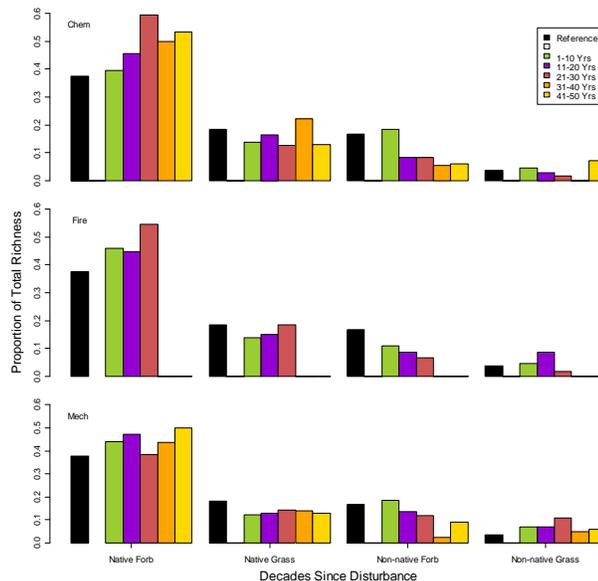
Quantifying Legacy Effects of Managed Disturbance on Sagebrush Steppe Resilience and Diversity

Dates:

2008-2010 (Completed)

Abstract:

We found that plant communities experienced a fundamental shift in composition following disturbance, and responded in a flat linear fashion, giving no indication of return to prior community composition or diversity. As expected, we found post-disturbance increases in the number of non-native grass species present. However, native forb species made the largest contribution to altered diversity. Disturbance modified functional group composition, so contrary to our expectations, within-state changes did not occur as a result of disturbance. Our results indicated that sagebrush steppe plant communities are not resilient to chemical, fire, and mechanical treatments, and subsequent to managed disturbance, community composition tips over a threshold into an alternate stable state.



Trend in proportion of total richness for native versus non-native plant species present on (a) chemical, (b) fire, and (c) mechanical sites over time since disturbance. Reference conditions are shown at the left of each functional group cluster for comparison.

Funding:

Natural Resources Conservation Service
Utah Division of Wildlife Resources

Investigators:

Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (PI)
Julie Ripplinger, Graduate Research Assistant (MS Ecology)

Reports:

Ripplinger, J. 2010. Quantifying legacy effects of managed disturbance on sagebrush steppe resilience and diversity. Unpublished MS Thesis, Utah State University, Logan, Utah.

Publications:

Ripplinger, J., and T.C. Edwards, Jr. Quantifying legacy effects of managed disturbance on sagebrush steppe resilience and diversity. In review, Journal of Applied Ecology.

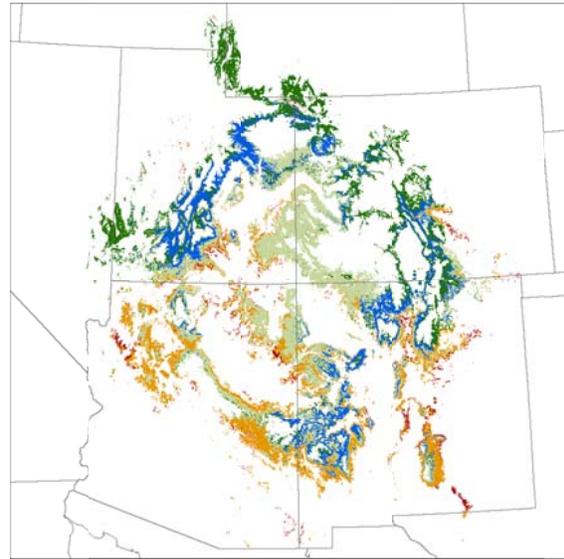
Individualistic Response of Piñon and Juniper Tree Species Distributions to Climate Change in North America's Arid Interior West

Dates:

2007-2010 (Completed)

Abstract:

Piñon and juniper species distribution models exhibited individualistic responses to modeled climate change. Modeled areal loss was greater than gain for all species, which is reflected in changes of co-occurrence. Piñon-juniper richness is forecast to increase in the northern Colorado Plateau, eastern Great Basin, and Rocky Mountains. The sister-species models forecast greater areal gain, and less areal loss, along hybridization zones for *P. edulis*-*P. monophylla* and for *J. occidentalis*-*J. osteosperma*, but forecast greater areal loss along the periphery of the component species distributions. The sister-species model for *J. deppeana* var. *deppeana*-*J. monosperma* forecasts overall greater areal loss than the component species. In general, forecast changes in latitude and elevation are about one third of the changes inferred, from the fossil record, to have occurred following the transition to the current interglacial ~10,000 years ago.



Modeled distribution through 2050 of *Pinus edulis* Common Piñon under projected climate change, Hadley A2 Scenario, Western North America.

Model identifies expansion and contraction tension zones where regeneration and growth is predicted to highest (greens), and trailing edges (reds) where mortality is expected to be greatest.

Funding:

USDA Forest Service, Rocky Mountain Research Station, FIA Program

Investigators:

Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (PI)
Gretchen G. Moisen, USDA Forest Service Rocky Mountain Research Station
Jacob Gibson, Graduate Research Assistant (MS Ecology)

Reports:

Gibson, J. 2010. Individualistic response of piñon and juniper tree species distributions to climate change in North America's arid interior west. Unpublished MS Thesis, Utah State University, Logan, Utah.

Publications:

In preparation.

A Multi-Scale Evaluation of Pygmy Rabbit Space Use in a Managed Landscape

Dates:

2007-2010 (Completed)

Abstract:

Throughout the intermountain American West widespread mechanical, chemical, and fire treatments are being performed to improve degraded sagebrush stands. While it is generally thought that these treatments will improve wildlife habitat, their effects remain unclear for many sagebrush-dependent species. Due to their reliance on sagebrush for both food and cover, and a preference for tall and dense sagebrush stands, the pygmy rabbit (*Brachylagus idahoensis*) is one of the species for which sagebrush treatments may be detrimental. The main goal of this dissertation is to evaluate distribution, relative abundance, and habitat selection of pygmy rabbits at multiple scales in order to improve management and conservation for this species.



Photo by J. Lefler

Funding:

Natural Resources Conservation Service
Utah Division of Wildlife Resources

Investigators:

Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (PI)
Tammy Wilson, Graduate Research Assistant (PhD Ecology)

Reports:

Wilson, T.L. 2010. A multi-scale evaluation of pygmy rabbit space use in a managed landscape. Unpublished Ph.D. Dissertation, Utah State University, Logan, Utah, USA.

Publications:

Wilson, T.L., J.B. Odei, M.B. Hooten, T.C. Edwards, Jr. 2010. Hierarchical spatial models for pygmy rabbit distribution and relative abundance. *Journal of Applied Ecology* 47:401-409.

Wilson, T.L., F.P. Howe, T.C. Edwards, Jr. In press. Effects of sagebrush restoration treatments on resource selection of pygmy rabbits. *Journal of Wildlife Management*.

Wilson, T.L., A.P. Rayburn, and T.C. Edwards, Jr. Spatial ecology of refuge exploitation by a vulnerable herbivore. In review, *Oikos*.

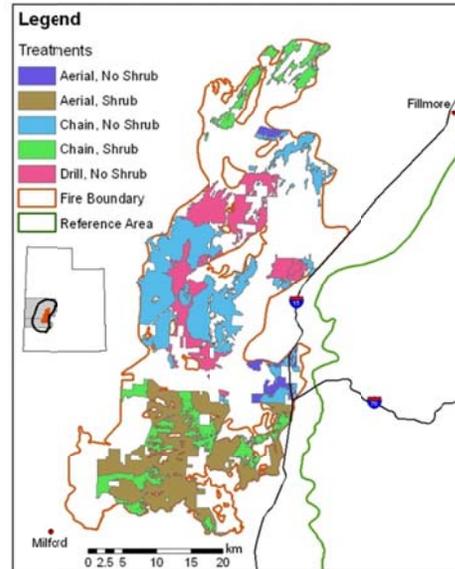
Avian Response to Post Wildland Fire Reseeding Treatments in the Great Basin Shrubsteppe

Dates:

2009-2011 (Ongoing)

Abstract:

The Milford Flat Fire was the largest wildfire recorded in Utah; considered catastrophic, concern exists that it would lead to a state change. To mitigate this state change, vegetation reseeding treatments were applied immediately post-fire. These treatments were two seed mix types, with or without a shrub component, and three mechanical applications, drill seeding, aerial seeding followed by chaining, and aerial seeding only. We are surveying the avian community in the different treatment types and in untreated areas within the fire. As there is no pre-fire data, we are sampling nearby areas of similar pre-fire habitat as reference. We are also collecting vegetation cover and structure data as covariates. These covariates will be used to identify any treatment effects.



Spatial locations of seeding treatments applied post-fire, Milford Flats, Utah

Funding:

Utah Division of Wildlife Resources

Investigators:

Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (PI)
Adam Brewerton, Graduate Research Assistant (MS Ecology)

Reports:

None; research on going

Publications:

None; research on going

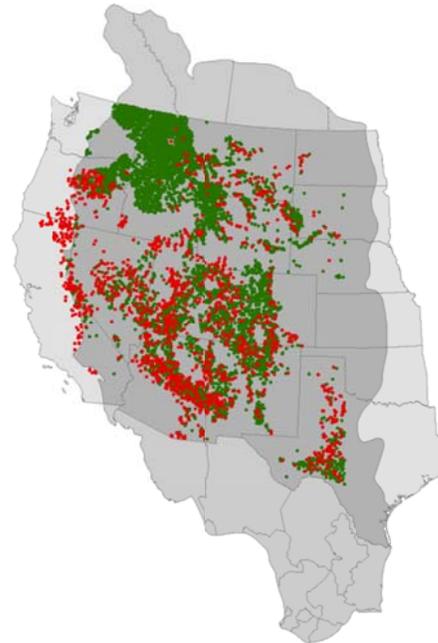
Modelling Climate Change Effects on North American Dry Mid-Latitude Conifers

Dates:

2009-2012 (Ongoing)

Abstract:

We are evaluating projected climate change effects on ~30 conifer species occupying the mid-dry latitudes of Western North America. The project involves three interrelated components. First, widely used climate projections (e.g., Daymet, WorldClim, and PRISM) will be downscaled to 100 m resolution for Western North America. Ensemble classifiers will next be used to model species distributions as functions of the downscaled climate variables to establish the relationships to current climate conditions. These models will then be linked with projected climate shifts and the potential shifts in species distributions evaluated. The third component focuses on defining the leading and trailing edges of the species distributions. Current hypotheses suggest that trailing edges of distributions are more vulnerable to catastrophic disturbances, while the leading edges are sensitive to climate shifts, and variance in current climate regimes.



Modelling domain for assessing climate change effects on conifers of Western North America. Red indicates piñon-juniper woodlands; green is all conifers

Funding:

USDA Forest Service, Rocky Mountain Research Station, FIA Program

Investigators:

Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (PI)
Gretchen G. Moisen, USDA Forest Service Rocky Mountain Research Station
Niklaus Zimmermann, Swiss Federal Research Lab WSL

Reports:

None; research ongoing.

Publications:

None; research ongoing.

Challenges in Assessing and Forecasting Biodiversity and Ecosystem Changes in Europe

Dates:

2007-2012 (Ongoing)

Abstract:

Research objectives are to evaluate the synergistic effects of land-use and global climate change on plant and animal distributions in western Europe using satellite-derived land-use transition matrices, hindcasting for land-use history, and predictive forecasting of potential gains/losses in species areal extents due to economic and ecological forces. I work with the Swiss Federal Research Lab WSL research group, with responsibilities for development of spatially explicit models of land-use from socio-economic data, and distribution models of selected plant and animal species and groups. The project is a 5-year research effort on global change effects involving a consortium of 19 European Research Institutions from 11 nations.



Funding:

European Union (funded through Swiss Federal Research Lab WSL, Birmensdorf, Switzerland)

Investigators (WSL associates only):

Niklaus Zimmermann and Felix Kienast, Swiss Federal Research Lab WSL
Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University

Publications (4 of 7 listed):

Edwards, Jr., T. C., Jr., F. Kienast, J. Bolliger, and T. Dalang. Maintaining high Alp dry grassland meadows of high conservation priority under short- and long-term ecological change. In review, *Biological Conservation*.

Bolliger, J., T. C. Edwards, Jr., S. Eggenberg, S. Ismail, I. Seidl, and F. Kienast. Dry grassland meadows of high conservation priority: balancing forest regeneration probabilities and maintenance costs. In press, *Conservation Biology*.

Zimmermann, N.E., T.C. Edwards, Jr., C.H. Graham, P.B. Pearman and J-C Svenning, Guest Editors. 2010. New trends in species distribution modelling. *Ecography* 33:985-1092. Special Issue: Species Distribution Modelling (10 Papers)

Albert, C. H., N. G. Yoccoz, T. C. Edwards, Jr., C. H. Graham, N. E. Zimmermann, and W. Thuiller. 2010. Sampling in ecology and evolution – bridging the gap between theory and practice. *Ecography* 33:1028-1037.

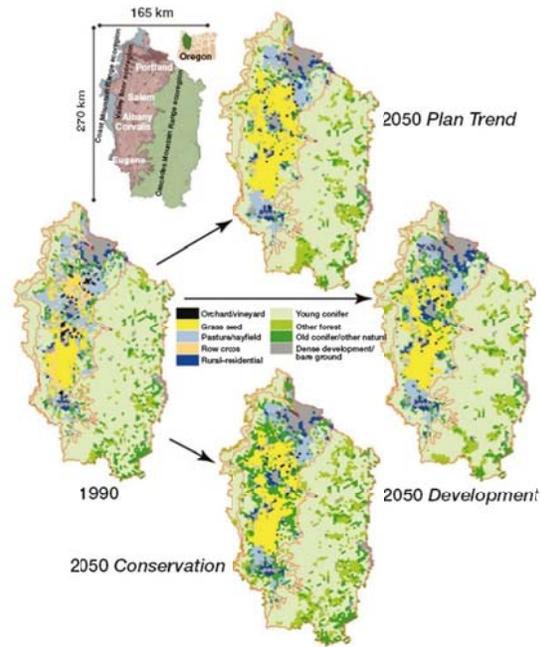
Sustainable Communities and Landscape Designs

Dates:

2010-2013 (new project)

Abstract:

Land cover and land use are known to affect the quality of a wide range of ecosystem processes and services. The distribution and pattern of land-use activities within a landscape or watershed can dramatically affect the quality of ecosystem services and well-being of societies. However, few studies have documented how community and city designs might affect the sustainability of ecosystem services. Most applications of ecosystem services in community and city planning have either been entirely conceptual, or are very early on in the process. This project will develop a set of landscape metrics and models to capture differences in landscape designs and will compare those indicator and model results to conditions of ecological attributes and ecosystem services. An outcome of the project will be new methodologies to evaluate sustainability of ecosystem services.



Modelling potential different future scenarios under different development storylines.

Funding:

U.S. Geological Survey

Investigators:

Thomas C. Edwards, U.S. Geological Survey UTCFWRU and Utah State University (PI)
K. Bruce Jones, U.S. Geological Survey
Felix Kienast, Swiss Federal Research Lab WSL
Postdoctoral Research Associate (TBD)

Reports:

None; research ongoing.

Publications:

None; research ongoing.

An experimental and modeling approach to predator-prey dynamics: identifying limitations of predator performance in high desert impoundments

Dates:

2010-2012

Abstract:

The lands of the Uintah and Ouray Reservation in northeastern Utah are home to a series of small, high desert impoundments. These waters have been stocked with a variety of fishes annually with little understanding of biotic or abiotic conditions that limit fish growth and performance. During summer 2010, we undertook a pilot study of seven small impoundments on the reservation, and completed comprehensive field monitoring of fisheries and limnological information, in order to design a greater study of predator-prey interactions. Results from this pilot study indicated several predator-prey interaction hypotheses which we aim to examine and test in the 2011 field season. We will implement a controlled field experiment through forage fish additions to examine growth limitations and develop a foraging model to investigate and quantify visual foraging efficiency of predators across systems. The overall goal of the project is to assist the Ute Tribe Fish and Wildlife Department in establishing an improved sampling protocol, a more cost and biologically efficient stocking program, and a better overall understanding of the waters on the Uintah and Ouray reservation.



Funding:

Ute Indian Tribe Fish and Wildlife Department, US Geological Survey – UCFWRU, USU Ecology Center, USU Graduate Student Senate

Investigators:

Phaedra Budy, Principle Investigator, USGS – UCFWRU, USU- Dept. of Watershed Sciences
Gary P. Thiede, Fishery Biologist, USU- Dept. of Watershed Sciences
Stephen Klobucar, Graduate Research Assistant (M.S.) USGS – UCFWRU, USU- WATS
{expected graduation, Fall 2012}

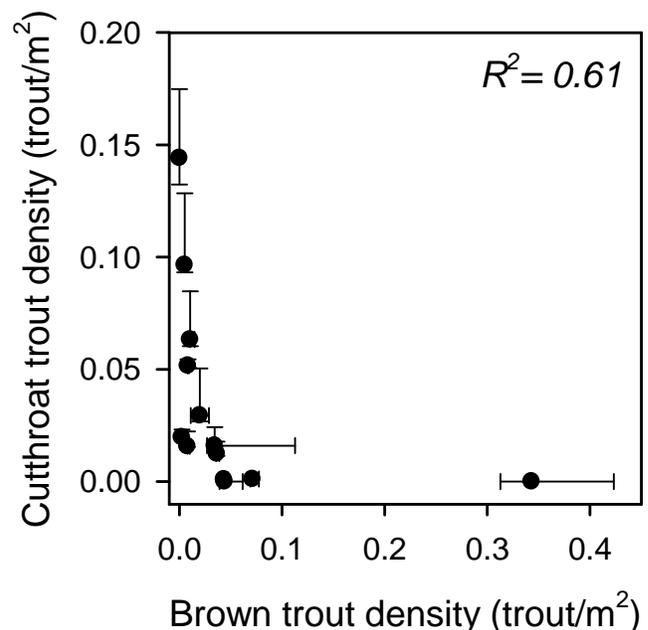
A test of the biotic resistance hypothesis with native and exotic trout assemblages in stream ecosystems: towards a better understanding of native cutthroat trout restoration options

Dates:

2009 – 2011 (Ongoing)

Abstract:

Bonneville cutthroat trout, endemic to Utah, are currently restricted to 33% of their historical range and are protected under a Conservation Agreement in an effort to avoid ESA listing. The Logan River supports one of the largest remaining meta-populations of this cutthroat trout species across its range; however, as elsewhere, these native trout are threatened by negative interactions with invasive brown trout. Towards a broader goal of gaining a better understanding of native trout restoration options, we are testing the hypothesis of biotic resistance in the Logan River using a large-scale, manipulative field study coupled with controlled laboratory experiments, and a meta-analysis of evidence for and against this hypothesis conducted at a larger spatial scale. The overall goal of this project and collaborative effort is to protect and conserve this extremely important meta-population of native trout and the popular sport fishery it supports. We will attempt this through brown trout removals, native cutthroat trout restoration (i.e., reintroduction), and monitoring and evaluation. Removal of brown trout conducted in 2009 and 2010 from tributary and mainstem habitat suggest that tributary habitat in the lower extent of the Logan River support very high densities of exotic brown trout that demonstrate strong density dependence and likely serve as a source of brown trout to the mainstem Logan River, whereas populations in portions of the mainstem Logan River are likely supported by immigration from small impoundments in the lower river.



Funding and collaborators:

Utah Division of Wildlife Resources, USGS UT-CFWRU, Trout Unlimited, Cache Anglers Chapter, US Forest Service

Investigators:

Phaedra Budy, Principle Investigator, USGS – UTCFWRU, USU – Watershed Sciences

W. Carl Saunders, Post-doctoral Research Scientist, USU – Watershed Sciences

Gary P. Thiede, Fisheries Biologist, USU – Watershed Sciences

Reed Chaston, Undergraduate Researcher, USU – Watershed Sciences

Publications:

Budy, P., G.P. Thiede, C. Meredith, and N. Burbank. 2010. Logan River whirling disease study: factors affecting trout population dynamics, abundance, and distribution in the Logan River, Utah. 2009 Annual Report to Utah Division of Wildlife Resources. Sport Fish Restoration, Grant number XIII. Project F-47-R. UTCFWRU 2010(2):1-55.

Bull trout population assessment in northeastern Oregon: a template for recovery planning

Dates:

2002-2011 (ongoing)

Abstract:

The goal of this project is to provide data and conservation assessment tools to aid the U.S. Fish and Wildlife Service's efforts to determine management actions necessary for recovery of bull trout, a species listed as Threatened under the Endangered Species Act. Each summer, researchers systematically capture and mark bull trout with unique tags and then re-sight marked individuals during subsequent sampling events at various locations throughout the watershed. Collecting data on several populations across consecutive years has allowed us to provide critical information on bull trout abundance, trend, vital rates, habitat needs, and movement patterns, and how these vary between different life-stages. Data from this study is currently being used to help build a population viability model to assess how elimination of current threats can help protect bull trout populations across the species' range.



Funding:

US Fish and Wildlife Service, US Geological Survey, and Utah Cooperative Fish and Wildlife Research Unit

Investigators:

Phaedra Budy, Principle Investigator, USGS – UCFWRU, USU- Dept. of Watershed Sciences

Gary P. Thiede, Fishery Biologist, USU- Dept. of Watershed Sciences

Tracy Bowerman, Graduate Research Assistant (PhD) USGS – UCFWRU, USU- WATS {expected graduation, 2011}

Selected Publications:

Al-Chokhachy, R. and P. Budy. 2008. Demographic characteristics, population structure, and vital rates of a fluvial population of bull trout in Oregon. *Transactions of the American Fisheries Society* 137: 1709:1722.

Al- Chokhachy, R., P. Budy, and M. Conner. 2009. Detecting declines in the abundance of a bull trout (*Salvelinus confluentus*) population: understanding the accuracy, precision and costs of our efforts. *Canadian Journal of Fisheries and Aquatic Sciences* 66: 649-658.

Reports:

Budy, P., T. Bowerman, and G.P. Thiede. 2010. Bull trout population assessment in northeastern Oregon: a template for recovery planning. 2009 Annual Progress Report to US Fish and Wildlife Service. UTCFWRU 2010 (3):1-48.

Degraded Habitat and Crowded Niche Space: Effect of Stream Degradation on Food Web and Population Structure of Imperiled Fishes

Dates:

2007-2011 (Ongoing)

Abstract:

We began investigating the interactions between physical habitat degradation and species invasions on three imperiled fishes (flannemouth sucker, bluehead sucker, and roundtail chub) in the San Rafael River in 2009. Prior research had demonstrated that these fishes are habitat-limited in this river; however, densities of these fishes are low even in areas with ample available habitat, suggesting the influence of other limiting factors. Invasive fishes are widespread in the San Rafael River below a fish barrier. Comparing the food web between the upper (no non-native fishes) and lower (densely populated non-native fishes) San Rafael River with stable isotope analysis, we find that the non-native fishes occupy a new, higher trophic position than was previously occupied in the river, and show a significant potential for competition with the native fishes over the limited resources in the system. We are examining the growth rates of the native fishes to determine if the potential competition suggested in the stable isotope analysis is resulting in slower growth in the presence of non-native fishes. Additionally, we are building a predictive model of relative risk throughout the river based on the relationships detected in our analyses in combination with a form of continuous sampling (i.e., aerial photos). This model will provide managers a tool to determine where restoration and management funds will be most effective in the San Rafael River.



Photos by K. Wilson

Funding:

US Bureau of Reclamation, Utah Division of Wildlife Resources, US Geological Survey – UCFWRU, USU-CNR Quinney Fellowship

Investigators:

Phaedra Budy, Principle Investigator, USGS – UCFWRU, USU- Dept. of Watershed Sciences
Gary P. Thiede, Fishery Biologist, USU- Dept. of Watershed Sciences
Tim Walsworth, Graduate Research Assistant (M.S.) USGS – UCFWRU, USU- WATS (Graduate 09/11)

Reports:

Budy, P., J. Bottcher, and G.P. Thiede. 2009. Habitat needs, movement patterns, and vital rates of endemic Utah fishes in a tributary to the Green River, Utah. 2008 Annual Report to the Bureau of Reclamation, Upper Colorado Region. UTCFWRU 2009(4): 1-56.
Budy, P., T. Walsworth, and G. P. Thiede. 2010. Habitat needs, movement patterns, and vital rates of endemic Utah fishes in a tributary to the Green River, Utah. 2009 Annual Report to the Bureau of Reclamation, Upper Colorado Region. UTCFWRU 2010(1): 1-45.

Publications:

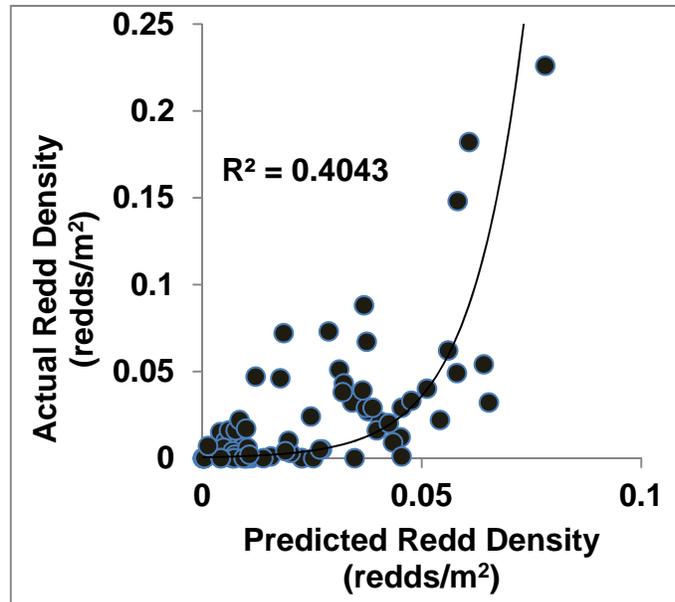
Bottcher, J. 2009. Maintaining population persistence in the face of an extremely altered hydrograph: Implications for three sensitive fishes in a tributary of the Green River, Utah. MS thesis. Utah State University.

Hydro-geomorphic Factors Influencing Brown Trout Distributions on the Logan River, Utah

Dates: 2008-2011

Abstract:

An understanding of the factors limiting brown trout population abundance at high elevations on the Logan River is critical to the future conservation of native Bonneville cutthroat trout (BCT). While brown trout outcompete BCT at low elevations, BCT continue to thrive at high elevations where brown trout are nearly absent. In this research, we are investigating potential influences of abiotic factors on the Logan River brown trout distribution, including scouring of brown trout fry during the spring flood, gravel availability, and temperature. Our results show that scour depths during the spring flood are not greater at higher elevations. However, brown trout fry at high elevations may be more susceptible to scour because a greater percentage of fry are still in the gravel during the flood. In addition, in a model of potential factors influencing brown trout spawning densities (including potential gravel availability, temperature, habitat variables, and distance from source high density spawning areas), the most informative predictive variables were potential gravel availability, distance from beaver dams, and distance from Third Dam (a high density spawning section). Our results illustrate that a combination of abiotic factors may contribute to low abundance of brown trout at high elevations, possibly related to the availability of habitat for spawning and the survival of early life stages.



Funding and Collaborators:

Utah Division of Wildlife Resources, USGS UT-CFWRU, Intermountain Center for River Rehabilitation and Research (ICRRR), US Forest Service

Investigators:

Phaedra Budy, USGS – UTCFWRU, USU – Watershed Sciences
Christy Meredith, PhD Student, USU, Watershed Sciences
Jack Schmidt, USU and ICRRR

Publications:

Budy, P., G.P. Thiede, W.C. Saunders, and C. Meredith. 2011. Logan River whirling disease study: factors affecting trout population dynamics, abundance, and distribution in the Logan River, Utah. 2010 Annual Report to Utah Division of Wildlife Resources. Sport Fish Restoration, Grant number XIII. Project F-47-R. UTCFWRU 2011(2):1-32.

Logan River long-term monitoring: factors affecting trout population dynamics, abundance, and distribution in the Logan River, Utah

Dates:

2001-2011

Abstract:

Abundance of Bonneville cutthroat trout (> 100 mm TL) varied greatly by sample site, ranging from 38 fish/km at the Third Dam site (the lowermost end of their distribution in the river) up to 822 fish/km at Franklin Basin. Population trend (λ) of cutthroat trout estimated for the entire Logan River population based on pooled site abundance estimates was 0.89 (0.77 – 1.02), indicating an apparent overall decline; however site-specific population trends are highly variable. Over the past nine years, clinical signs of whirling disease were observed in less 1% of fish handled ($n > 10,000$ fish). Prevalence of *Myxobolus cerebralis* in cutthroat trout was 50 – 100%.

The distribution of cutthroat trout and brown trout show a distinct species-zonation pattern (Figure 1). Our results provide important conservation and recovery benchmarks for identifying range-wide limiting factors of Bonneville cutthroat trout. Our studies indicate that future conservation efforts for Bonneville cutthroat trout should be prioritized to protect areas where land-use activities might damage spawning and rearing habitat during the sensitive spawning and early life-stage periods. Further, we continue to recommend a precautionary approach to the management of this endemic and important population overall; potential options include habitat protection or restoration and the continued removal of exotic brown trout in high priority habitats.

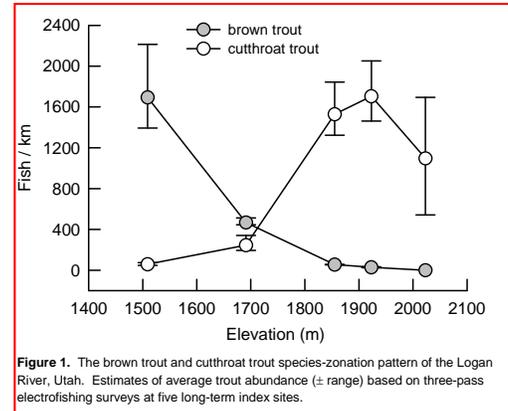


Figure 1. The brown trout and cutthroat trout species-zonation pattern of the Logan River, Utah. Estimates of average trout abundance (\pm range) based on three-pass electrofishing surveys at five long-term index sites.

Funding:

Utah Division of Wildlife Resources, Sport Fish Restoration, & USGS Utah Cooperative Fish and Wildlife Research Unit

Investigators:

Phaedra Budy, Principle Investigator, USGS- UTCFWRU, USU-Dept. of Watershed Sciences

Gary P. Thiede, Fisheries Biologist, USU-WATS

Christy Meredith, Graduate Research Assistant (PhD) USGS-UTCFWRU, USU-WATS {expected graduation, 2011}

Carl Saunders, Post-doctoral Fellow, USU-WATS

Publications:

McHugh, P., and P. Budy. 2005. An experimental evaluation of competitive and thermal effects on brown trout (*Salmo trutta*) and cutthroat trout (*Oncorhynchus clarkii utah*) performance along an altitudinal gradient. *Canadian Journal of Fisheries and Aquatic Sciences* 62:2784-2795.

McHugh, P., and P. Budy. 2006. Experimental effects of nonnative brown trout on the individual- and population-level performance of native Bonneville cutthroat trout. *Transactions of the American Fisheries Society* 135:1441-1455.

Budy, P., G.P. Thiede, P. McHugh. 2007. A quantification of the vital rates, abundance, and status of a critical population of endemic cutthroat trout. *North American Journal of Fisheries Management* 27:593-604.

Budy, P., G.P. Thiede, P. McHugh, E.S. Hansen, and J. Wood. 2008. Exploring the relative influence of biotic interactions and environmental conditions on the abundance and distribution of exotic brown trout (*Salmo trutta*) in a high mountain stream. *Ecology of Freshwater Fish* 17:554-566.

McHugh, P., P. Budy, G.P. Thiede, and E. VanDyke. 2008. Trophic relationships of nonnative brown trout, *Salmo trutta*, and native Bonneville cutthroat trout, *Oncorhynchus clarkii utah*, in a northern Utah, U.S.A. river. *Environmental Biology of Fishes* 81:63-75.

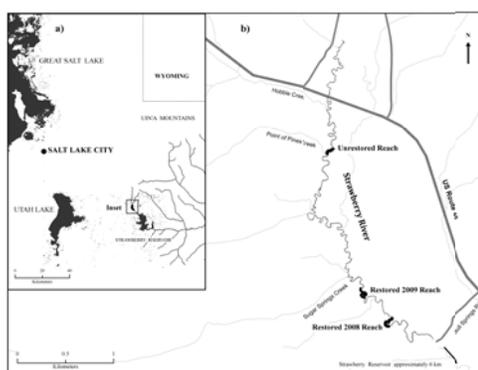
Multi-scale monitoring of geomorphic and biological responses to instream restoration: Strawberry River, Utah

Dates:

2008-2010

Abstract:

In this study, we investigated whether physical changes following instream restoration activities had ecologically relevant effects on Bonneville cutthroat trout in the Strawberry River, a site of an ongoing instream restoration project typical of many in the Intermountain West. We collected geomorphic and ecological data to help improve the effectiveness of restoration and adaptive management strategies by targeting biologically limiting conditions, monitoring at ecologically relevant scales, and identifying the link between restoration-induced physical change and biological response.



In addition to establishing important baseline data for future monitoring, two years of habitat and fish population surveys produced five main findings: 1) beaver activity can cause measureable physical changes equal to or greater than those following restoration, including an increase in flow depth and pool frequency; 2) BCT habitat quality is limited by a lack of deep water, pools, and instream cover; 3) a reduction in one limiting variable (in this case, cover) results in a large decline in the estimated proportion of high quality habitat according to habitat suitability indices, 4) the estimated proportion of high quality habitat does not increase immediately after restoration ('as-built' conditions), and 5) in order to determine whether apparent increases in BCT populations on restored reaches are biologically significant, it is imperative to incorporate BCT life cycle dynamics and stocking information into the analysis.

Funding:

Intermountain Center for River Rehabilitation and Restoration, Utah Division of Wildlife Resources (UDWR), Endangered Species Mitigation Fund

Investigators:

Nira L. Salant, Post-doctoral Research Fellow, USU-Department of Watershed Sciences
Scott W. Miller, BLM/USU National Aquatic Monitoring Center, USU-Department of Watershed Sciences
Phaedra Budy, USGS-UCFWRU, USU-Department of Watershed Sciences
Jack C. Schmidt, USU-Department of Watershed Sciences
Chris Luecke, USU-Department of Watershed Sciences
Marshall Baillie, USU-Department of Watershed Sciences
Nic Braithwaite, USU-Department of Watershed Sciences

Reports:

Miller, S.W., Salant, N.L., Budy, P.E., and Schmidt, J.C. 2010. Assessing responses of Bonneville cutthroat trout to restoration strategies implemented under the 1997 Conservation Agreement. Report submitted to the Utah Division of Wildlife Resources Endangered Species Mitigation Fund (Project No. 0809). February, 2010. ICRRR 2010(1):1-122.

NOTES